Space Weather Technical Forecast

Issued on Tuesday, 27 September 2022 at 01:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of R1/Minor Radio Blackouts throughout. Chance of G1/Minor geomagnetic storms Day 1 (27 Sep). Slight chance of Active fluence.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Low with C-class flares observed. The peak flare was a C4.7 at 26/0911 UTC from AR3107. This is one of six active regions on the disc, and is also close to AR3105 in the southern central disc. Very little growth has occurred in either region, although both are showing some opposite polarity spots giving them beta-gamma magnetic configurations. The largest region, in terms of area, is currently AR3110 in the northeast quadrant but this has a simpler magnetic layout. There are also three further small and simple regions on the disc. No Earth-directed CMEs have been observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, has been at background speeds although with a recent rise, perhaps indicative of the onset of CH26/- but also with some possible weak CME influence. Wind speeds were steady around 300 km/s, but have risen slowly since 26/1900 UTC to reach 360 km/s. The density has gradually increased and been above average for much of the period, but has recently increased further peaking well above average at 57 ppcc at 26/2336 UTC. The total Interplanetary magnetic field strength, Bt, was weak for much of the period, increasing after 26/2000 UTC to become strong peaking at 16 nT. The north-south component, Bz, varied weakly until 26/2100 UTC when it became moderately southward directed with a peak of -13nT. The phi angle switched from positive (away from the Sun) to negative (towards the Sun) around 26/0830 UTC, before becoming more variable after 26/1850 UTC. Geomagnetic activity was Quiet (Kp 0 to 2), with an Unsettled interval after 26/2100 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16, remained just slightly raised above normal background levels, but well below S1 levels. High energy electron flux (greater than 2 MeV) peaked at High levels, reaching 2640 pfu at 26/1640 UTC. The associated 24-hour fluence was just below the Active (1e8 integrated pfu) threshold. Observed fluence at 27/0000UTC was 7.67e7 integrated pfu.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is forecast to be generally Low, with a chance of isolated M-class flares, primarily from AR3107.

Solar Wind / Geomagnetic Activity: Solar winds are currently at background speeds but the speed is rising with elevated density, likely due to the onset of CH26/- combined with some weak CME influence. The connection to CH26/- is expected to continue through Day 1 and into Day 2 (27-28 Sep), likely easing later Day 2 into Day 3 (29 Sep). Peak wind speeds are likely to be near 500 km/s. Geomagnetic conditions are likely to be Unsettled to Active, with a chance of G1/Minor Storm during Day 1, easing through Day 2. Conditions easing to mainly Quiet Day 3 onwards.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is

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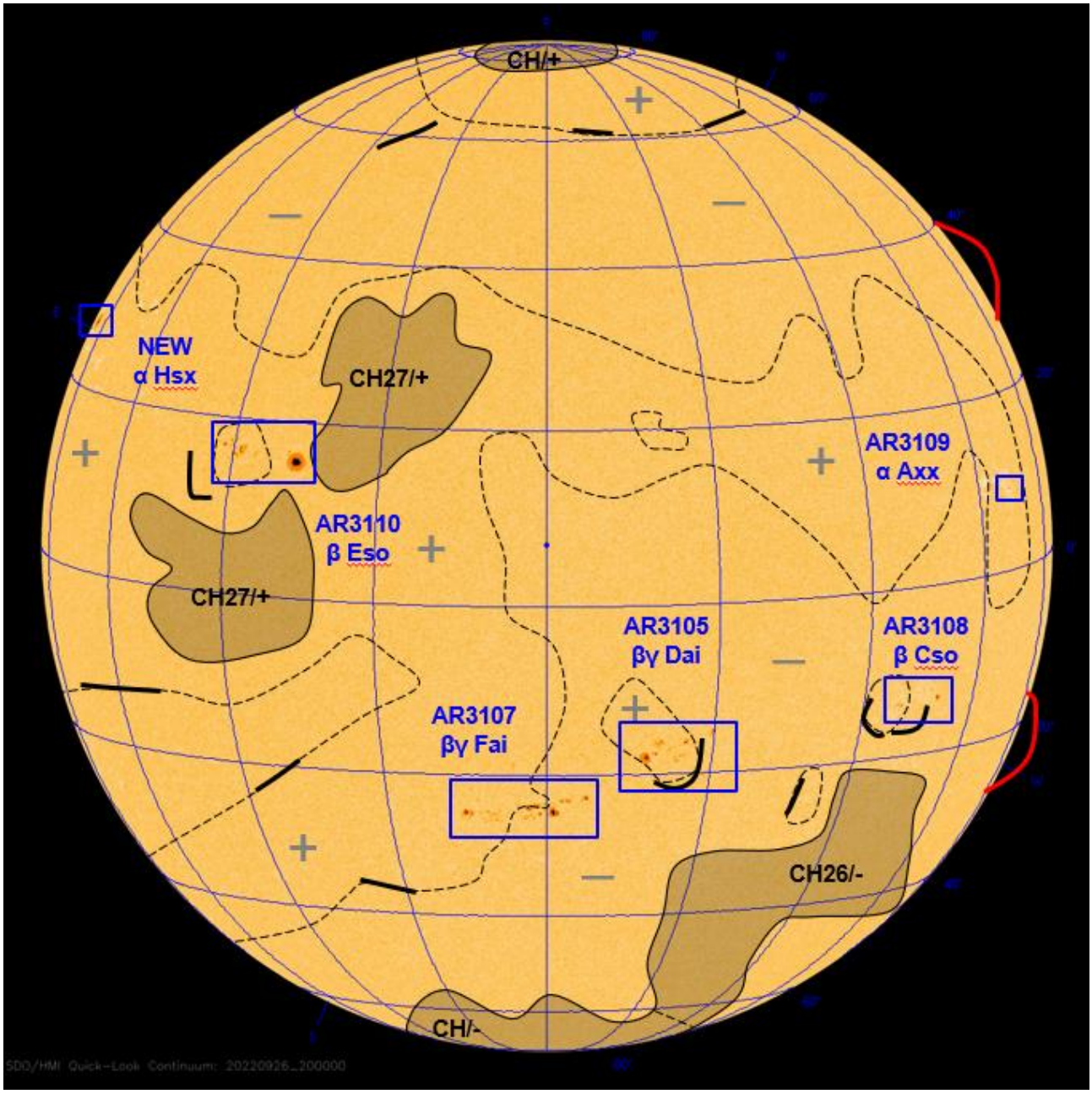
expected to persist at background levels, with a very slight chance of reaching S1, most likely from AR3107 and AR3105. The high energy (greater tan 2MeV) electron flux is most likely to see peak values decline. The associated 24 hour fluence is most likely to remain below the Active (1e8 integrated pfu) threshold, but is currently close to Active with just a slight chance of rising above through this period.

Figure 1. Solar Analysis Valid 26/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Solar winds are currently at background speeds but the speed is rising with elevated density, likely due to the onset of CH26/- combined with some transient influence, maybe associated with the weak CME(s) from the 21 and 22 Sep.

The connection to CH26/- is expected to continue through Day 1 and into Day 2 (27-28 Sep), likely easing later Day 2 into Day 3 (29 Sep). The 27 day solar wind persistence suggests an enhancement up to 500-600 km/s at this time, however this signal was contaminated by CME arrivals on the previous rotation. Enlil connected Earth to this feature on the 25th, which was too early, but is still likely giving a good guide on potential peak winds, of around 500 km/s. Due to the negative polarity of the feature, any geomagnetic activity is expected to be fairly limited at this time of year.

Geomagnetic conditions are likely to be Unsettled to Active with a chance of G1/Minor Storm during Day 1, easing through Day 2. Conditions easing to mainly Quiet Day 3 onwards.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
22/2058	Partial	Coronal dimming	NW	400 km/s	Possibly early 27 Sep	Low confidence

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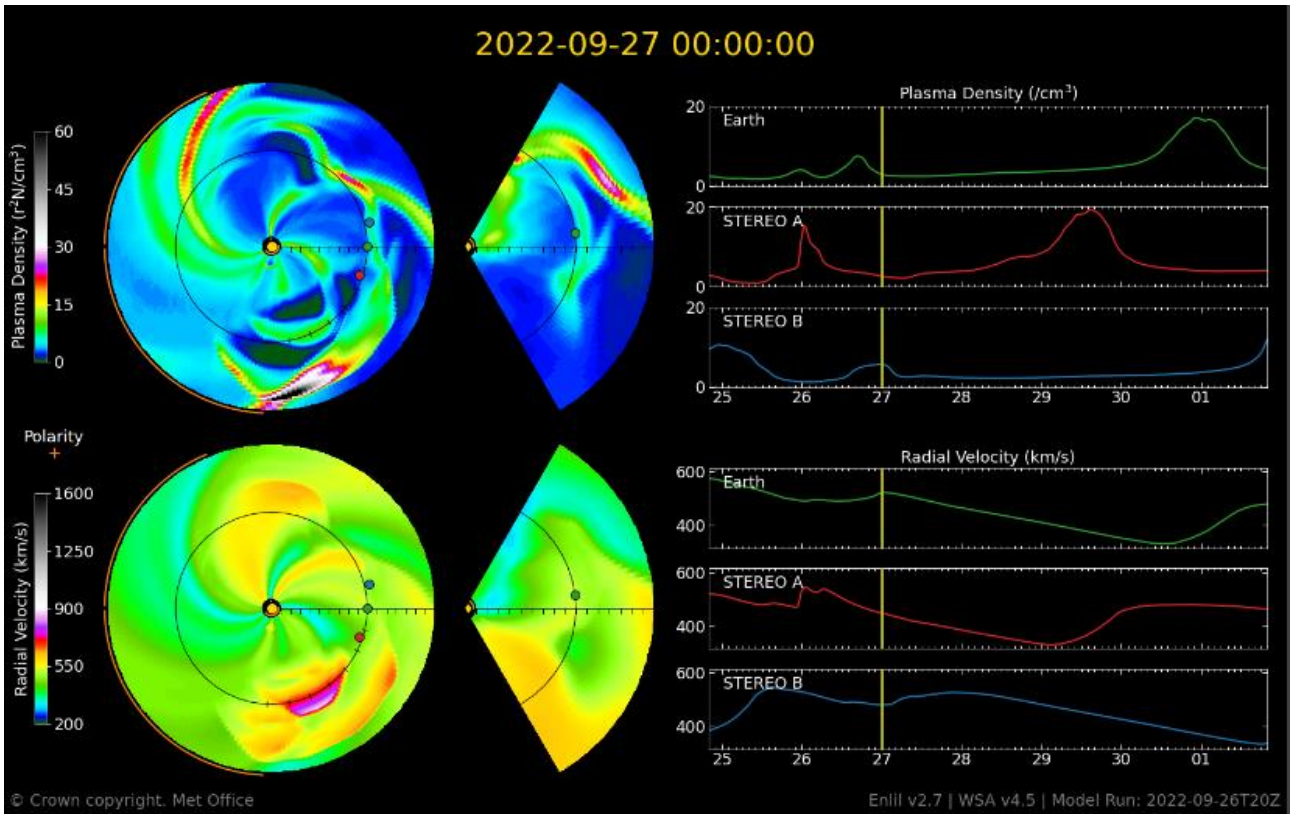
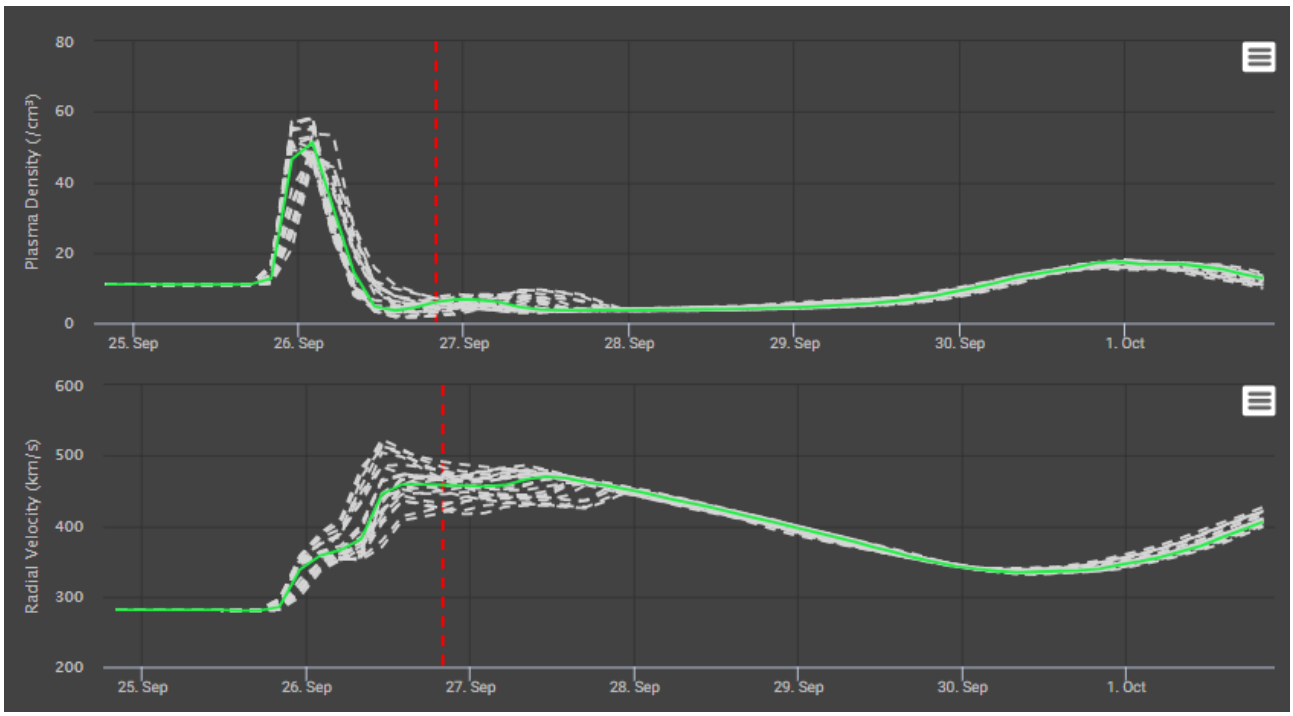
Figure 2: MOSWOC Enlil and ensemble showing possible CME glancing blow, although this may already have arrived. Enlil is currently too high with wind speeds, but is likely a reasonable guide to peak speeds from CH26.





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Radio Blackouts - X-Ray Flares:

Solar activity has been Low with six sunspot regions on the disc. Low activity is likely to continue, with a chance of isolated M-flares.

A complex of two longitudinally extensive sunspots - AR3105 (Dai/Beta-gamma) and AR3107 (Fai/Beta-gamma) is currently traversing the central southern disc. The latter of these was the source of a long period C4.7 flare, which was the peak observed in the last 24 hours. The magnetic configuration of these regions shows some minor complexity with an opposite polarity spot near the trailer of AR3105 and the leader of AR3107, resulting in the beta-gamma classification. As such, these do have the potential to produce M-flares.

The other main region of note is AR3110 (Eso/Beta) in the northeast. This has the largest penumbral areal size of the current spots, and also has the potential for M-flaring, but is currently a simple and stable bipolar region. The other regions appear mainly small and simple, although the new region rotating onto the northeast limb may not be fully visible and could yet reveal trailing spots.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) observed by GOES16 is expected to remain very close to background levels. A very slight enhancement is continuing, but this is well below S1 levels. The main risk of any proton enhancement is from AR3105 and AR3107, as they move into the southwest disc.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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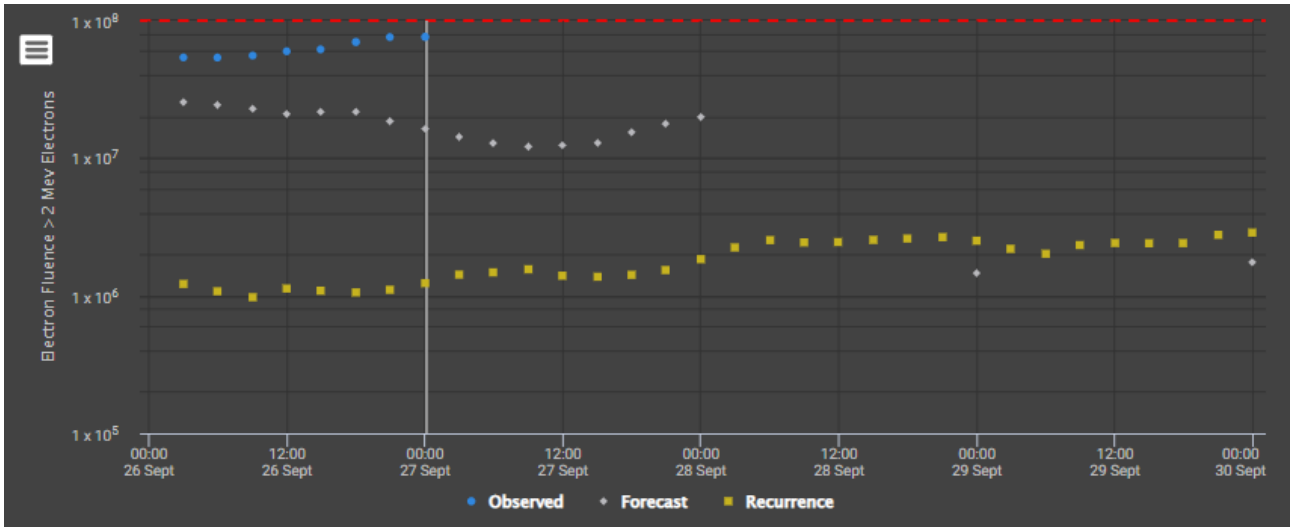
High Energy Electrons Event (≥ 2MeV):
The high energy (greater tan 2MeV) electron flux, as observed by GOES-16 has been varying between Moderate and High levels, but has recently dropped likely due to the recent arrival of the HSS from CH26 combined with some possible weak CME influence. As such peak values on Day 1 (27 Sep) are likely to be lower than recent values. Any response to the incoming HSS is unlikely to occur until near the end of the period.

The associated electron 24 hour fluence is most likely to remain below the Active (1e8 integrated pfu) threshold, but is currently close to Active and there is just a slight chance of rising above during Day 1. Subsequent fluence levels depend strongly on how fast the wind speed associated with CH26 becomes, and any geomagnetic activity associated with it. However, fluence levels are most likely to drop in the short term, with a rise possible towards the end of the period. REFM is currently under estimating fluence levels, however the trend for below Active fluence is considered reasonable.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	5	10	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: MOSWOC REFM is currently under estimating fluence levels, but is showing a reasonable trend.



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